

The Vermont Soil Health Trust: Why and How

Introduction

This report is an output of the project titled *Coordinating Public and Private Funding with a Science-Based and Stakeholder-Driven Pay-for-Performance Conservation Approach*, which is funded by USDA - NRCS through the Conservation Innovation Grants program. This project has two related, but distinct, objectives. Objective 1 is to design a pay-for-performance conservation program to incentivize farmers to reduce P losses from their fields and farms. Objective 2 is to suggest ways that public and private resources could be coordinated to create a ‘basket’ of incentives for more transformative change toward dramatically improved soil health on Vermont farms. This report is an output of Objective 2; it describes the problems being addressed and a framework for part of the solution. Based on scores of meetings and interviews, a framework for the “Vermont Soil Health Trust” (the Trust) has been designed and is described here.

The Trust would serve two primary purposes. First, it would implement a payment for ecosystem services (PES) program that is focused on improved soil health. Second, for farmers who are interested in making transformative changes toward regenerative agriculture, or “all-in”¹ soil health on their farm, the Trust would help them to develop and implement transformation plans - plans that can improve farm financial performance while greatly improving soil health and delivering ecosystem services (ES). The Trust would provide focused technical assistance (TA) to help farmers develop the transformation plan, as well as subsidized financing for plan implementation.

This report:

1. Provides context, justification, and design criteria for the Vermont’s Soil Health Trust
2. Provides a description of the Vermont Soil Health Trust (summary and detail)
3. Describes farm transformation scenarios
4. Explores the need to address farm debt
5. Provides recommendations for next steps.

Context, Justification, and Design Criteria for Vermont’s Soil Health Trust

The intersection of the dairy farm financial crisis with the growing urgency to find solutions to the water quality and climate problems, provides the opportunity to feed two birds out of one hand. By transforming their cropping and/or livestock management systems, dairy farms could improve farm financial viability and resilience while at the same time improving water quality and reducing net GHG emissions. Creating these pathways for transformation will require working across facets of the public and private sectors.

Improved financial performance means that farms will not require on-going public investments or subsidies to produce ecosystem services (although payments for these services may increase their production). However, creating the pathways for widespread dairy farm transformation requires

¹ Although not prescriptive on specific practices, the concept of “all-in soil health” is achieved by stacking multiple agronomic practices in appropriate combinations, such as cover crops, no-till, and soil-conserving crop rotations, or through well-managed grazing systems. In this report, we use the term “regenerative agriculture.”

significant investment now. Planting the seeds of change today will yield an on-going stream of economic and environmental benefits into the future.

There are many ways to improve soil health. Although not prescriptive on specific practices, the concept of “all-in” soil health is achieved by stacking multiple agronomic practices in appropriate combinations, such as cover crops, no-till, and soil-conserving crop rotations, or through well-managed grazing systems. NRCS identifies five core principles of soil health: Soil Armor (keeping soil covered); Minimizing Soil Disturbance; Plant Diversity; Continual Live Plant/Root; and Livestock Integration. This approach is known as “regenerative agriculture.” A graphic of these principles can be found in the Appendix A.



Going “All In” for Soil Health: Regenerative Agriculture

In soils observed to reach the soil health zone, multiple management practices that support soil biology are used:

- **Soil Armor: Soil covered year-round**
 - Diverse (not single) cover crops
 - Cover crops rolled down or cash crops planted into covers
- **Minimal Disturbance**
 - No-till or reduced till (depending on soil type)
- **Live roots in the ground year-round**
- **Plant/Microbial Diversity**
 - Crop rotations
 - Intercropping
 - Integration of permanent crops/trees/buffers
 - Addition of compost, manure, microbes, inoculants
 - Reduced inputs (fertilizers, chemicals, pesticides, herbicides)
- **Livestock integration**

Regenerative agriculture can generate several crucial ecosystem services (ES), such as mitigating global climate change, improving water quality, and reducing the severity of flooding events.

All In Soil Health / Regenerative Agriculture: Carbon Sequestration + Powerful Co-Benefits



soil health



climate resiliency



water quality



biodiversity above
and below ground



farmer, farm worker,
and rural economics



food security and
access

Regenerative agriculture should also improve soil productivity and reduce costs of production, which would improve farm financial performance and resilience. As more farmers realize the benefits, regenerative agriculture is likely to become an on-going and permanent approach and adoption should increase over time.

Regenerative agriculture produces improved water quality, carbon sequestration and flood resilience. These ESs are of great and increasing value to society and paying farmers is a very cost-effective way to secure them, as well as the rural community benefits that a healthy farm sector provides. Many farms will need to transform their production system to deliver these ES. Transformation can be risky and/or expensive and farms are likely to need financial and technical support.

The goal of the Trust is to provide farmers with the technical assistance (TA) and financing needed to transform their farms to regenerative agriculture. This includes TA for farm planning, access to capital to implement the plans, and payments for the environmental outcomes that are created.

This project was initiated with a focus on Vermont dairy farmers due to the challenges that sector faces. However, the proposed Trust could apply to all farming sectors in the state.

The Trust concept was developed based on extensive conversations with farmers, extension agents, public funding agencies, public policy advisors, non-profit organizations, and private investors. To be successful, the Trust (or its evolution) must address several important design criteria, such as:

- Address the constraints of excessive farm debt. Farmers with a lot of debt may not be as willing to make changes because they do not want to risk impeding the farm's cash flow. On dairy farms, high debt per cow forces farmers to focus on maximizing milk production per cow, which can be at odds with grazing or other the practices that build soil health. Addressing farm debt should help to increase farmers' risk tolerance for changes that impact soil health.

- Help farmers estimate and assess agronomic and economic benefits from farm changes. Business planning resources, ideally working in concert with agronomic and livestock advisors, can model and project the financial impact of various changes, including any payments for ecosystem services to the farm. Leading soil health farmers emphasize the need for better and more targeted information about the finances of regenerative agriculture.
- Offer one-stop access to funding and financing. This will simplify the process for farmers and increase their interest in participating. This will enable farmers to focus on farming rather than navigating the increasingly complex sources of funding and financing.
- Mitigate risk for private funders. Private impact investors are not philanthropists. They need repayment, a return on investment, and clarity on the impact achieved with their funds. The successful use of public funds may be a necessary precursor to attracting private funding.
- Provide adequate technical assistance. The *Agriculture and Food System Plan: 2020, VT*, produced by VT Agency for Agriculture, Food and Markets and Farm to Plate, estimated that as many as 21 additional full-time personnel are needed to assist Vermont farmers. The Dairy Business Innovation Center (DBIC) has found that mentoring and training are critical for supporting farmer transition to regenerative agriculture. To be useful, all farm plans must be tailored to location, soil type, and operations.
- Leverage existing structures in the State. To reduce redundancy and save costs, the Trust should leverage the organizations and resources already working on soil health and ecosystem outcomes in Vermont. This includes current federal and state funding sources.

Description of the Vermont Soil Health Trust - Summary

The goal of the Vermont Soil Health Trust (the Trust) is to support the transformation of farming in Vermont toward dramatically improved environmental and financial performance. The Trust will help farmers transform their operations to build soil health and pay farmers for the environmental benefits that their healthy soil creates. Initially, the Trust is focused on dairy farms, but other types of farms could and should also be included.

There are many ways to improve soil health. The Trust does not prescribe specific practices but is focused on the concept of “all-in soil health”, otherwise known as “regenerative agriculture.”

Regenerative agriculture stacks multiple agronomic practices in appropriate combinations, such as (but not limited to) cover crops, no-till, and soil-conserving crop rotations, or through well-managed grazing systems. Healthy soil can generate several crucial ecosystem services (ES), such as mitigating climate change, improving water quality, and reducing the severity of downstream flooding events.

Regenerative agriculture will improve soil productivity and reduce costs of production, which will improve farm financial performance and resilience.

Regenerative agriculture produces improved water quality, carbon sequestration and flood resilience. These ESs are of great and increasing value to society. Paying farmers for the production of ESs is often a very cost-effective way to secure them. Strengthening the farm sector will also benefit rural communities. Many farms will need to transform their production system to deliver these ESs.

To help build and maintain a healthy farm sector in Vermont, the Trust would 1) provide the financial and technical support that farmers need to design and implement a pathway to regenerative agriculture

and 2) facilitate ES payments to farmers for quantified environmental outcomes. To achieve both of these, the Trust would operate two related funds:

- **The Farm Transformation Fund** would provide interested farmers with the financial and TA resources necessary to transform to regenerative agriculture. A TA team of agronomy, dairy/livestock, and farm finance experts would work with each farmer to develop a farm transformation plan. Each farm-specific plan would contain estimates of productivity and financial performance, as well as ES generation. Improved profitability and divestment of unnecessary equipment would free up cash for new investment, if needed. Debt restructuring may be necessary for some farms. The projected flow of ES could be used to determine financing terms and to justify public investment in the transformation.
- **The Outcomes Fund** would implement one or more pay-for-performance (PFP) programs that provide the framework, metrics, and tools to quantify the relevant ESs and pay farmers for what they produce. The Outcomes Fund would aggregate carbon and water quality credits and market them through all available channels. Revenue from credit sales would augment the Outcomes Fund to be able to reward more farmers for environmental outcomes.

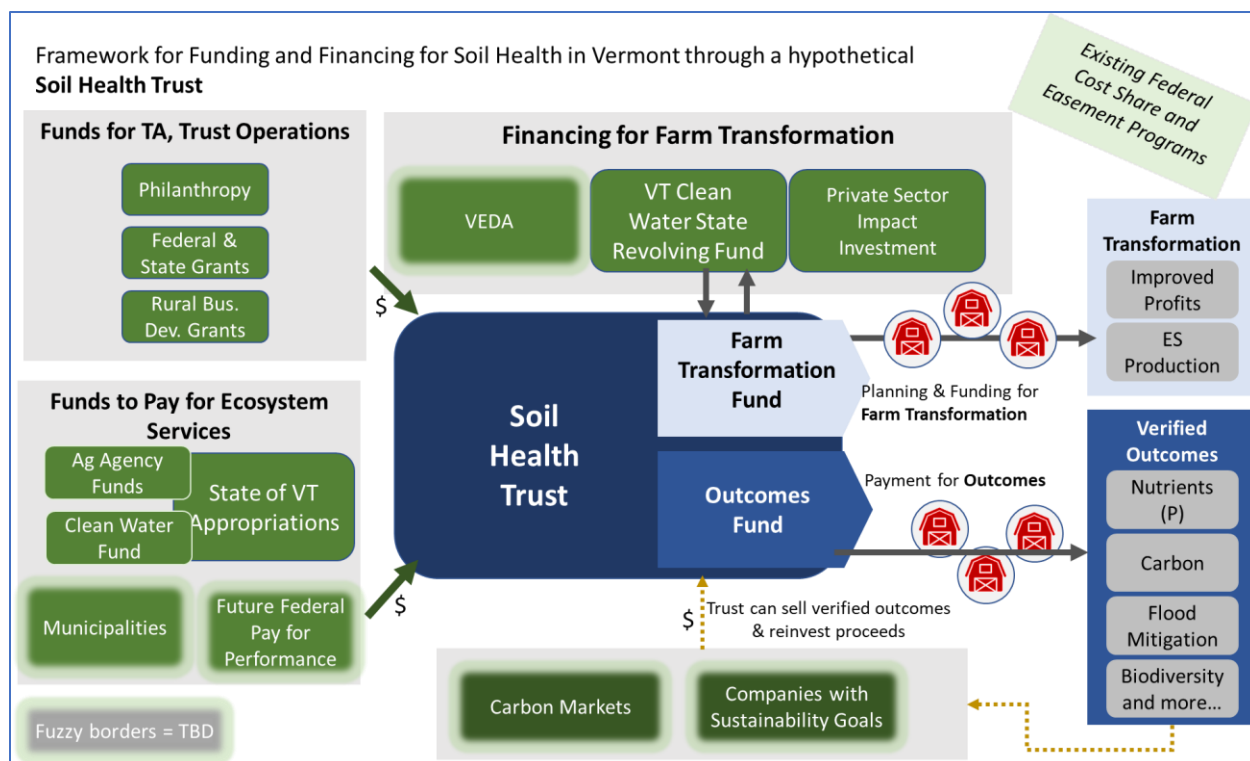
Funding for the Trust would be anchored by public funding sources who care about the outcomes of regenerative agriculture. These sources could include:

- Vermont Water Quality Fund → water quality (through reduced run-off)
- Vermont Clean Water State Revolving Fund → water quality (through reduced run-off)
- Rural Development → farm economic viability (profitability and weather resilience)

In addition, the USDA-NRCS and FSA fund work related to soil health, conservation, and farm economic resilience. These funds would not flow through the Trust but could be paired with funding from the above sources that flows through the Trust.

The Trust would also identify additional and emerging funding sources. For example, funding to increase carbon sequestration may become available through the Global Warming Solutions Act (GWSA). This could become an important opportunity to support farmers and rural economies, and address climate change. Finally, the Trust would identify foundations and other grant-based funding that could be used to address soil health, such as the new Northeast Dairy Business Innovation Council (DBIC) effort to support the transition of conventional dairy farms to grazing models.

The Trust will also seek to harness funding and financing from private impact investors, as well as companies in the supply chain. The environmental, rural community, and farm financial benefits produced by the Trust could generate significant interest from the private sector.



Description of the Vermont Soil Health Trust - Detail

The Trust will help Vermont farmers achieve financial viability and build soil health, which will in turn help preserve Vermont's agricultural landscape, sustain the state's agricultural economy, and restore the health of the natural ecosystems in the state.

The Trust will operate two separate but related funds, the Farm Transformation Fund, and the Outcomes Fund, to help Vermont agricultural producers design and implement plans for regenerative agriculture, and help farmers get paid for the ESs created on their land, respectively.

By increasing and improving farmer access to funding and technical assistance, and providing outcomes payments, the Trust would help farmers improve their soil, their financial viability, and the production of ESs.

The Trust would identify and aggregate financial resources (state, federal and private) and write grant applications to access funds to: invest in farm transformations, pay for TA, make ES payments to farmers, and fund its operating overhead. In addition, the Trust would deploy targeted performance-oriented TA, and track and report on environmental outcomes.

The Outcomes Fund

The Outcomes Fund would implement one or more pay-for-performance (PFP) programs that quantify the relevant ESs and pay farmers for what they produce. The Outcomes Fund could aggregate carbon and water quality credits and market them through all available channels. Associated revenue from credit sales would help the Trust to work with more farmers through the Outcomes Fund. The related but separate Farm Transformation Fund helps farmers make the changes that will result in greater environmental outcomes.

Coordination across ongoing PFP Efforts

The Outcomes Fund could coordinate the ongoing and future efforts to develop pay-for-performance conservation programs in the state. The Trust framework could be adopted and adapted by ongoing PFP efforts. It will be more efficient to have coordination and ongoing management of key details, including:

- Outcomes measurement tools, models, and protocols (see below)
- Development and oversight of third-party verification
- Engagement with farmers to encourage and support participation
- Data management and tracking to ensure accuracy, integrity, and transparency
- Collection and organization of farmer case studies
- Raising funds to pay farmers for ESs, as well as the costs of operating the fund
- Aggregating ES benefits for potential sale as Credits (Carbon or other ES)

Needed outcomes measurement tools, frameworks, and models

Myriad details and coordination are required to design and operationalize a PFP Program, including defining the units of measurement, pricing, quantification, and verification. The Vermont PES Working Group² would be well-suited to guide the development of these details including whether farmers get paid for new (i.e., additional) outcomes or current performance or both. Research suggests that:

- “Outcomes” should be quantified on a field-specific basis.
- In many cases the quantification of outcomes will rely on modeling tools because direct measurement, while preferable is often impractical or prohibitively expensive.
- Modeling tools should reflect the influence of soil type, grade, and other relevant factors when determining the quantity and quality of associated outcomes.
- The outcomes should be verified, ideally by a third party, to ensure consistency, transparency, and validity.

Emerging standards include programs to support farmers with information and other resources for transition, such as Regenerative Organic Certification, Land to Market and Soil Carbon Index. These programs can help participating farmers accelerate their readiness for the emerging carbon markets. Farmers who participate in these programs and complete their baseline soil tests will be able to demonstrate improved carbon sequestration sooner (many carbon markets require 3 - 5 years between baselines and measurements).

Potential Funding for the Outcomes Fund

The Outcomes Fund would initially be funded by outcome-oriented state funding sources that can pay directly for ecosystem services, or that are authorized to pay for technical assistance. Philanthropic support would also be important. Over time, additional funding may come from agriculture companies who are willing to pay for verified ecosystem benefits.

Public Sources

Anchor funding for the Outcomes Fund should come from state of Vermont appropriations for clean water, carbon sequestration and soil health. The Vermont Clean Water Fund could pay for nutrient loss

² Information on the Vermont PES Working Group can be found at: <https://agriculture.vermont.gov/pes>

reduction and other water quality outcomes. Healthy soil also sequesters carbon; future appropriations associated with the Global Warming Act could flow through the Outcomes Fund to pay farmers for carbon sequestration. Future federal PFP funding could flow through the Outcomes Fund as well; federal policy seems to be moving in the direction of PFP.

In addition, there may be COVID infrastructure funds that could be used for the Soil Health Trust. And the currently reconciliation bill include over \$100 million for agriculture that is very loosely allocated.

The Outcomes Fund would function alongside, not in place of, existing public programs, including NRCS and FSA programs, that pay for soil health practices. Accessing these programs will lower farmers' cost of producing those outcomes.

Philanthropy

Grants from foundations could fund, in part, the TA that would be required to implement a pay-for-performance conservation program. Technical assistance staff would be needed to work with farmers on analysis of ways to reduce P loss from their fields, for example. They would meet with farmers to discuss options and would produce field-specific information on ES outcomes and costs from various scenarios that would help farmers to find the most appropriate and cost-effective changes to make on each field. In addition, foundations and philanthropists interested in the ESs might issue grants to make ES payments to farmers.

Agriculture Companies

Growing concern from consumers about climate change and environmental quality compels agricultural supply chains to demonstrate that they are addressing carbon, water, biodiversity, and/or other issues. After the Outcomes Fund pays farmers for the ESs produced from their land each year, these ES "outcomes" would be owned by the Trust. The Trust could sell verified outcomes or "credits" to agriculture companies who are seeking to meet their Sustainable Development Goals, or Scope 3 Commitments, or to make other corporate claims around soil, water, or climate.

By aggregating across farms, the Trust would spread the transactions cost of items such as monitoring, reporting, and verification, which may make the sale of carbon or other ES credits more financially feasible for the farmers who produce them. Proceeds from the sale of credits by the Trust would be reinvested to pay for future performance-based payments to additional Vermont farmers.

The Farm Transformation Fund

The Farm Transformation Fund (FTF) provides 1) TA to interested farmers to develop farm transformation plans that improve financial resilience *and* increase the flow of ES from the land, and 2) access to low-cost financing (debt, micro-loans and grants) to implement the plans. Farmers would not be required to participate in the FTF to participate in the Outcomes Fund. The FTF is for farmers who are interested in making more radical changes to the way that they farm for financial reasons but would also produce more ES. It is presumed that farmers who participate in the FTF would also participate in the Outcomes Fund.

Farm Transformation Plans

Farmers would start by working with a coordinated TA team to develop a farm transformation plan. A farm transformation plan, to be sustainable and attractive to the farmer and lenders, should improve soil health and farm financial performance.

Farm transformation plans should:

- Be achievable and practical given the farm's resources and farmer's desires
- Be sound from a financial and production perspective and based on conservative assumptions
- Include short- and long-term projections of cashflow and profitability, which requires
- Increase cash flow and profits so that loans can be repaid
- Use conservative estimates of crop and animal productivity, as well as prices and costs
- Be thorough enough to satisfy potential lenders
- Include reasonable estimates of the relevant ESs that would be produced if the plan were implemented. At a minimum, the ESs estimated should include P loss and C sequestration.

The Trust would develop templates to make process easier for farmers and TA teams. It would also select modeling tools for estimating ES production and produce case studies that could be used for education and outreach. The Trust should also provide support staff to help TA teams with needed tasks, such as organization, formatting, and document production.

Technical Assistance

Farmers interested in developing farm transformation plan would likely be best served by having access to a team of highly skilled and effective technical assistance providers. These TA teams could be coordinated by the Trust and should include a farm business advisor, an agronomist and a livestock expert, and other advisors as needed. Farmers should be able to appoint trusted advisors to the team also. The technical assistance team members could be employed by Extension, an NGO, or as private consultants.

To create greater efficiency, the Trust should use some type of performance contracting for the TA teams. The performance contracts would contain incentives for TA teams to work quickly and efficiently, but also produce the greatest satisfaction and value to each farmer served.

As part of developing each plan, the TA teams should document each farm's baseline financial and environmental performance, as well as how much this performance is expected to improve with the plan over time.

Trust staff, not necessarily the TA teams, should develop case studies of successful farm transformation plans. The would be used for subsequent outreach and education efforts. Over time, farmer-to-farmer knowledge sharing may reduce the demand for intensive TA teams. Once an initial set of farms can demonstrate positive financial and environmental outcomes from regenerative agriculture, momentum should propel this concept toward scale.

Potential Financing Models Offered by the Trust

The type of funding and financing that a farm needs from the Trust will be determined by the type of transformation a farmer is interested in making. For example, transformation to a regenerative cropping system may require little, if any, capital investment. It may be helped by government cost-share programs or require investment in a no-till planter, a roller-crimper, or other equipment, which could be funded or financed through existing federal and/or state programs. Still, to get uptake by farmers, they may need compensation to offset perceived short-term risks, such as potential yield losses. Low- or no-interest micro-loans could be used to help de-risk the adoption of regenerative cropping by farmers.

Alternatively, transformation to a larger-herd grazing model will likely require significant investments in farm infrastructure and more cows. For some farms, making additional investments may require debt restructuring. The FTF should coordinate with state and federal agencies, as well as private lenders, to help participating farmers restructure and/or reduce debt, in exchange for the future production of increased ESs resulting from the implementation of the farm transformation plan.

Recognizing that one size does not fit all, the Trust should attempt to be a one-stop shop to create options and facilitate change for farmers. Regardless, the FTF should offer debt consolidation and debt restructuring, as needed, to enable farmers to implement their farm transformation plan. Ideally, the FTF could offer more attractive financing terms for a greater level of ecosystem services produced per unit of land; Better financing terms could be justified by the reduction in production risk that comes from healthier soil.

Potential Sources of Farm Transformation Funding and Financing

The Farm Transformation Fund will require financial resources to help farmers implement their plans but will also need funding to cover the TA costs. The TA for farm transformation plans that address critical water quality goals in Vermont (e.g. Lake Champlain TMDL) could come from the Clean Water Fund. The TA to develop plans not anticipated to have a direct water quality benefit might come from state or charitable sources that are interested in addressing climate change, farm financial viability or the protection of the state's working landscape.

The amount of financing needed to implement the farm transformation plan will vary depending on the scope and scale of the project, as well as the farm's current financial condition. Financing could come from public and private sources.

- The primary public source of capital investment in farm transformation could be the Vermont Clean Water State Revolving Fund (SRF). The SRF can invest in agriculture, either directly or through a partner such as VEDA or the VLT. This financing would only apply to transformations with a water quality benefit.
- Additional financing might come from Rural Development, where the farm transformation improves the viability of small rural farms. RDBG funds could be used to capitalize a revolving fund.
- Some private impact investors (e.g., High Meadows Fund, TapRoot Capital Fund, Castanea Foundation) are already putting money into Vermont farms to support their transformation to organic or regenerative modes of production. These investors seem to be most interested in preserving farm economic viability and Vermont's working landscape, with a secondary focus on the environmental benefits of water quality and carbon sequestration. Similarly, such impact investors may find the Trust an efficient way to deploy capital to affect positive change.

The FTF might need to administer separate funds based on the objectives of different sources (e.g. rural economic development vs. water quality).

An obstacle to direct investment in farms is the high level of existing farm debt which makes the farm too risky. In some cases, refinancing could free up cash from debt service. This is discussed in greater detail in the section "The Need to Address Farm Debt" below.

The Example of Farm Transformation through Regenerative Cropping

A regenerative cropping transformation often does not require significant (or in some cases any) net new capital but does often require new skills, potentially reconfigured machinery, and time. These farms need help de-risking the change.

Micro Loans to De-Risk Transformation

The FTF micro loans could be issued by the Fund to cover the risk of yield loss. There may be multiple way to do this. For example, if a farmer anticipates a 10% yield drag in three years of regenerative crop conversion but expects to bounce back in year four, may not be able to implement the changes without funding to cover the risk of cash shortfall. The FTF could lend the difference between revenue from anticipated and actual yield, with the farmer repaying the loan after year four when cash flow improves. Over time, the Trust will develop financial models of the actual yield loss that could help farmers and the Trust anticipate and quantify the risks of farm transformation.

When transformations improve water quality, the Clean Water SRF could provide funding, through the FTF, for the micro-loans. In addition, RBDG funds could potentially be used to capitalize a Revolving Fund focused on lending working capital to small dairy farms that are adopting soil health practices. The Trust would administer the micro loans to farmers and determine appropriate loan payments based on yield.

Ecosystem Grants to De-Risk Transformation

The Trust could issue grants to farmers to cover yield loss or for working capital during the years of transition. This could be modeled on the BMP Challenge Program used by the American Farmland Trust. The BMP Challenge offered a guarantee against yield loss to farmers who adopted best management practices for the first time. Farmers were paid for any loss in profit resulting from the new practices.

For transformations that create a water quality benefit, The Clean Water Fund could provide funds. The Trust would track and report on the resulting water quality outcomes.

The Value-Added Producer Grant (VAPG) might also be relevant. The outcomes could be viewed as a “value added product,” and the VAPG could fund planning or working capital costs that the farm incurs as the transform to be able to deliver those outcomes. VAPG funds planning and working capital for producing and marketing a value-added product.

The Example of Farm Transformation to a Different Livestock Management Model

In this model, the FTF would provide “patient” capital (low interest loans, long repayment terms) to finance farm transformation to a different operating model, for example, a larger herd grazing-focused operation. This could also apply to a transformation to a different type of livestock. Unlike a regenerative cropping transformation, these may require significant investment capital.

Public funding sources could provide investment capital where the transformation provides appropriate outcomes (e.g., CWSRF for water quality, Rural Development for farm viability). These public funds could be paired with private investment capital to create financial instruments that work for impact investors and farmers. In some cases, CWSRF might need a private investor to secure a risky loan. In other cases, low cost public funds could be blended with higher cost private capital with fewer restrictions, to create affordable financing for a farmer to implement his/her farm transformation plan.

For transformations that benefit water quality, the financing elements could include:

- **Pooled Water Quality Projects.** The FTF could create a pool of investment-worthy farm transformation plans that improve water quality on credit-worthy farms. The Trust could receive low-cost financing from state, federal and private sources including the CWSRF. The Trust would then lend these funds to a portfolio of farms, allowing the CWSRF to diversify its risk and outsource some of the investment due diligence to the Trust.
- **Blended public-private capital.** Private investment capital seeking a higher rate of return is blended with public funds accepting low or no interest to create loans that farmers could afford.
- **Linked Deposits.** CWSRF (perhaps working through the Trust) would form agreements with private lending institutions to provide below-market interest rate loans to qualifying farmers for approved water quality projects. The VT CWSRF does not have personnel to oversee a Linked Deposit Program, but potentially the Trust could manage such a program.
- **Loan guarantees.** CWSRF funds could secure loans for projects that benefit water quality, in the same way FSA (Farm Services Agency) secures loans for conservation projects, effectively lowering the farmers' borrowing rate. Where the farm is too risky for CWSRF, possibly private funders would be willing to secure the loans.

Similar structures could be explored with other public funding sources where the farm transformation achieves the objective of the agency in question, such as Rural Development for farm economic viability, and in the future and entity resulting from the Vermont Global Warming Solutions Act for on-farm carbon sequestration.

Farm Transformation Scenarios

This section briefly discusses two farm transformation scenarios that improve soil health and greatly improve financial performance. The five principles for improving soil health include: (1) keeping the soil covered, (2) minimizing soil disturbance, (3) keeping living roots in the ground all year, (4) including plant and microbial diversity, and (5) integrating livestock into cropping systems. Although these principles can be achieved in many ways, we will describe two relevant categories of change as examples. These include cropland management and low-input, larger-herd dairy grazing systems.

Regenerative Cropping Farm Transformation

This is multiple, stacked practices that work together to achieve at least the first four soil health principles ((1) keeping the soil covered, (2) minimizing soil disturbance, (3) keeping living roots in the ground all year, (4) including plant and microbial diversity), and all five (integrating livestock into cropping systems) for livestock farms. It can include various combinations of cover cropping, no-till, soil-enhancing crop rotations, soil amendments, and even biological enhancements. A small but growing number of farmers throughout the Midwest and Mid-South are sharing very impressive results from innovative cropping systems they are using.

For example, Rick Clark, who farms 7,000 acres in Indiana, uses diverse cover crops in an all no-till system with soil-enhancing crop rotations to grow corn, beans, wheat, peas, hay, and other crops. Although he is not a dairy farmer, he produces feed for a large dairy nearby. Producing forages for the dairy allows Rick greater flexibility in crop rotations and provides access to manure for his land, both of which help him to further boost soil health. Compared to 2011, when Rick farmed in a more conventional manner, he calculates that he is now using 50% of the fuel and synthetic nitrogen, and zero

monoammonium phosphate (MAP), potash and lime. He estimates that he is saving over \$90 per acre without any reduction in yield.

Making this type of transformative change requires thorough planning and access to some different equipment. A key piece of equipment for Rick is a 60' wide roller-crimper that he uses to terminate growing cover crops in the Spring. In his system, he plants corn and soybeans directly into green and growing cover crops and then uses the roller-crimper to terminate the cover crop. The corn and soybeans grow up through the crimped cover, which creates an armor on the soil and suppresses weeds. His cover crops are often a cocktail of 8 or more species to improve diversity.



Rick Clark

Case Study: Clark Land & Cattle

Williamsport, Indiana

Background

- 5th generation farmer, Purdue Ag Grad
- Farms with his dad & nephew

7,000 Acres

- 1/3 farm 3 crop rotation (commodity)
- 1/3 farm 4 crop rotation
- 1/3 farm diversifying into specialty grains
- All no till, diverse cover crops, livestock integration
- 100% organic or organic transition; 100% nonGMO
- No starter fertilizer, fungicide, insecticide, seed treatment

What is important to know – financial results

- Saves over \$800,000 on input costs alone every year
- Net profitability totals about \$100/acre over Purdue Farmer Expectations model; maintains or exceeds yields
- Documents greater weather protection – less weather impact (flood, drought, wind); improves risk management
- Rick's "stacked practices" management system now accelerates soil to the healthy soil zone in 3–4 years when he acquires new land

Case Study: Clark Input Reduction & Cost Savings

Input	2011	2018	2020	2011- 2020 % Reduction	Annual Savings
Diesel Fuel (gallons)	30,011 gallons	15,151 gallons	15,460 gallons	48.5%	\$35,000
Horsepower	3350	1200	1200	64.2%	n/a
Synthetic Nitrogen	220 lbs/acre	110 lbs/acre	0	100%	\$220,000
MAP (phosphate+N)	330 tons	27 tons	0	100%	\$138,000
Potash (potassium)	400 tons	0	0	100%	\$142,000
Lime (calcium)	2,100 tons	0	0	100%	\$53,000
Chemistry	\$40/acre	0	0	100%	\$240,000
Total Savings (\$)	n/a	n/a	n/a	n/a	\$828,000

Source: Rick Clark

Although a much smaller roller-crimper would suffice on most Vermont farms, the Trust could help farmers acquire the equipment that they need to get started on this type of a transformation of their cropland management. According to Rick, all tillage equipment can be sold from the farm, which can often offset the cost of any additional equipment needed.

Rick strives to create a systematic approach to regenerative farming that reduces costs and maintains crop yields. Adaptations of this and similar systems for the Northeast exist and are being improved upon by farmers every year. The Trust could help Vermont farmers acquire the equipment and the technical assistance that they need to get started on this type of a transformation of their cropland management.

Technical and Structural Changes

Rick added several practices over the course of a few years.

- Diverse cover crops, no-till, and a mix of 3 and 4 crop rotations
- Plants corn and soybeans directly into green and growing cover crops and then uses the roller-crimper to terminate the cover crop. The corn and soybeans grow up through the crimped cover, which creates an armor on the soil and suppresses weeds. His cover crops are often a cocktail of 8 or more species to improve diversity
- No starter fertilizer, fungicide, insecticide, or seed treatments.

Estimated Costs

Rick had minimal cash outlay associated with this transformation. Proceeds from the sale of tillage equipment paid for the roller crimper. He was able to significantly reduce inputs, creating savings of \$90 per acre (after paying for additional seeds). Rick relied on farmer-to-farmer networks for TA.

Low-Input, Larger-Herd Dairy Grazing

Low-input, larger-herd dairy grazing systems have great potential to be financially and environmentally resilient. This system is a modification of the New Zealand dairy grazing system, but designed to work in

the Northern U.S. The focus of this system is maximizing the percentage of nutrients in the herd's ration that come from grazed pasture forage at a scale that generates adequate revenue. There are three important metrics that make this system work: (1) low feed costs per hundredweight (cwt.) of milk produced, (2) adequate amount of milk sold per full-time worker, and (3) low total assets (and debt) per cow.

Creating this type of dairy farm generally requires significant changes to the farm's infrastructure. To produce over 1 million pounds of milk per worker will require an efficient milking system. A high throughput milking parlor that can allow each person to milk at least 100 cows per hour is preferable. Building such a parlor is likely to cost several hundred thousand dollars. Assuming that the herd average for a full-on grazing farm may be in the area of 14,000 lbs. per cow per year, at least 75 cows per worker will be necessary; increasing the herd size will require additional investment. The milking parlor and cows may qualify for low-interest loans or grants from rural development or environmental agencies. Fencing, water system, and cattle lanes will also be necessary investments. These may be able to be funded through existing USDA and state cost-share programs.

The value of depreciable assets, such as machinery and buildings, as a percentage of total farm assets should be much lower for this type of farm than for a conventional dairy farm. This type of farm maximizes the value of the money-making assets, such as cows and land, relative to the value of machinery and buildings needed on the farm.

The environmental benefits from this type of larger herd, low-input dairy grazing system are many. By having all land in permanent vegetative cover soil is held in place which reduces erosion and nutrient transport to surface water, as well as sequestering C in the soil and providing wildlife habitat. By maximizing nutrient intake from grazed pasture forage with minimal grain supplementation, the farm will be closer to a mass nutrient balance which reduces the risk of nutrient pollution to surface and ground water.

The Need to Address Farm Debt

Vermont's farming sector, particularly dairy, is preserving Vermont's cultural heritage and driving its rural economies. In many cases these farms are struggling financially. Farm debt is perhaps the largest obstacle to change on Vermont Farms, and addressing farm debt is critical to improve farm viability and to improve the ES production on agricultural land. To enable farmers to adopt regenerative agriculture (which will improve farm financial viability and produce ESs), many will need to reduce (or at least restructure) their debt to lower their monthly debt service payments. Restructuring farm debt should be a priority of public and private entities that are interested in Vermont's working landscape, rural economies, climate change mitigation and water quality.

Agriculture lenders might consider adjusting their loan terms for farms that are building soil health. Farms with healthier soil are likely to have lower financial risk compared to other farms, *ceteris paribus* (i.e. all else being equal). Research has shown that building soil health improves the financial performance of individual farms by lowering input costs, increasing weather resilience, and producing ecosystem services which may become saleable. Loans to farms that are building healthier soils should reflect this reduced risk. Ideally, loan terms could become more favorable as risk is reduced. And, to the extent that outcomes payments are available to a farm, this would improve their revenue and further reduce their borrowing risk. Ideally, agriculture lenders will consider offering preferential loan terms in

exchange for the delivery of ecosystem services or achieving soil health benchmarks. Documenting the relationship between healthier soil and lower farm financial risk is an important need.

Entities interested in soil health outcomes could invest some of their capital to restructure farm debt. For example, CWSRF funding can be used to refinance loans that have a water quality impact. While not currently able to restructure debt for soil health, FSA seems poised to be an excellent potential source. FSA engages in debt reduction/debt forgiveness through the Conservation Contract Program. The Conservation Contract program could be extended to provide debt forgiveness in exchange for ecosystem services.

Innovative policy examples could be looked at to develop ideas for farm debt restructuring models. For example:

- Student loan forgiveness program in which loans are forgiven in certain circumstances, such as for public service.
- Medical debt forgiveness program. In one model, a non-profit aggregates charitable donations and buys medical debt for pennies on the dollar, thereby targeting those most in need of debt relief. This can be seen at <https://ripmedicaldebt.org/>. Is there an opportunity for public and private sources to work together to buy down debt in Vermont's dairy sector in exchange for future ESs?
- A program to expand the FSA Conservation Contract program, to not only keep sensitive lands out of production, but the keep working lands in production and producing ESs. American Farmland Trust has recommended this become part of federal policy through their Debt for Working Lands Initiative.
- There might be an opportunity for the state to put up a debt relief fund through which they could buy down farm debt in exchange for soil health outcomes. In this scenario, the farm would implement soil health practices, and in exchange the fund would buy down the debt from the bank, leaving the farmer with no or less debt. There would need to be a source of money to capitalize the debt relief fund.

Recommendations and Next Steps

The concept of the Soil Health Trust described in this report offers a framework for coordinating and harnessing a variety of resources (i.e. funding, financing, TA) from a variety of levels (i.e. state, federal, local, private) to help Vermont farms maximize the ecosystem services they produce, as well as their long-term financial health. Overall, the foundation for the Soil Health Trust could be used as a template to facilitate alignment across the myriad groups working to improve farm viability and ecosystem outcomes.

Below is a set of recommended next steps to continue the exploration and development of this concept as an efficient mechanism to achieve crucial environmental goals and a resilient agricultural sector in Vermont.

1. Develop examples of farm transformation by working with 3-5 Vermont farmers interested in going “all-in” on soil health on their farms and transforming to regenerative agriculture. The goals of this work would be to (1) understand the specific costs and benefits of a wide range of transformation scenarios by assessing multiple scenarios for each farm, (2) estimate the TA

costs associated with creating a thorough farm transformation plan, and (3) create templates and processes to maximize the efficiency of TA resources utilized by the Farm Transformation Fund. This work would benefit by securing some mentorship from farmers who are successfully implementing regenerative agriculture systems in other states.

2. Create a policy roadmap with specific recommendations for providing financial resources to the Soil Health Trust from specific sources, with a particular focus on State of Vermont funding. This work should be done in close collaboration with state legislators, legislative staff, and/or their designees.
3. Inventory and assess all the various modeling and measurement tools and processes that could be used to quantify each of the ES that the Trust wants to incentivize. A set of criteria against which each tool or process can be assessed and ranked should be developed at the beginning of this work. The ES that the PES Working Group has identified include water quality, climate change mitigation, and flood resilience. Including biodiversity and/or other ES could also be considered. Existing tools and frameworks should be considered, including programs to support farmers with information and other resources for transition, such as the Regenerative Organic Certification, Land to Market and Soil Carbon Index.
4. Facilitate engagement of Vermont's agricultural lenders. The goal of this work is to inform and educate lenders on the impact of improved soil health on farm financial risks, as well as to create alignment and foster cooperation toward the mutual goals of more robust (i.e. lower risk) farm businesses and healthier ecosystems.

This Soil Health Trust framework could be considered by the Vermont PES Working Group, which is interested in facilitating transformative changes on Vermont farms to produce a variety of ecosystem services including water quality, climate change mitigation, and flood resilience. Regardless of the entity to move the Trust forward, the recommendations above are likely to provide crucial information necessary for progress on this concept.

